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Tapeworms of forest micromammalians (*Rodentia* and *Insectivora*) from Kampinos Wilderness

Tasiemce drobnych ssaków leśnych (*Rodentia* i *Insectivora*) z Puszczy Kampinoskiej

Studies on the helminthofauna of micromammalians (*Rodentia* and *Insectivora)* conducted till now in Poland included: the Białowieża Wilderness (Sołtys, 1949, 1952, 1954), environs of Puławy (Żarnowski, 1954, 1955), environs of Lublin (Furmaga, 1957), and environs of Turew near Poznań (Pojmańska, 1957). The present work presents new faunistic data and jointly with other data enables to define more exactly the distribution of tapeworms occurring in Poland in micromammalians.

Material

During the summer (June — September) 1957 I collected the helminthological material from *Rodentia* and *Insectivora,* occurring in the Kampinos Wilderness in the environs of Dziekanów Leśny near Warsaw.

I made 56 helminthological dissections. The evidence of the examined hosts and their parasites is given in Table I.

The number of the host species found (7 species) is relatively not large. Sołtys (1949, 1952, 1954) found in the region of the Białowieża Wilderness 4 species of *Rodentia* and 5 of *Insectivora,* Żarnowski (1955) in the environs of Puławy 10 species of *Rodentia* and 5 of *Insectivora,* Furmaga (1957) in the environs of Lublin 8 species of *Rodentia* and 5 of *Insectivora.*

In spite of the relatively small number of the host specimens found, the material collected represents the typical assemblage of small mammals occurring in this region. The above statement is

supported by the investigations carried out during last 4 years in the Department of Ecology of the Polisch Academy of Sciences in the region of Dziekanów Leśny.

The results show * that the mammalian species I have found in

Table I

Species of host	No. of examined specimens	Number of invaded specimens				
					larvae	
		Cestoda	*Trematoda*	*Nematoda*	*Cestoda*	*Trematoda*
Clethrionomys glareolus Schreb.	7	5	—	2	—	—
Apodemus agrarius Pall.	5	—	—	2	1	4
Apodemus flavicollis Melch.	8	1	—	6	2	—
Mus musculus L.	1	—	—	1	—	—
Muscardinus avellanarius (L.)	5	—	—	—	—	—
Sorex araneus L.	28	26	18	11	—	—
Sorex minutus L.	2	2	2	1	—	—

the region studied, belong to the most common forms, with regard to the other species only two (*Microtus agrestis* L., *Micromys minutus* Pall.) have been occasionally found. In addition to the species discussed, there occures comparatively aboundant *Neomys fodiens* Schreb., not found by me presumably because it lives in a different ecological niche.

The region studied is a forest markedly mixed both as regards

* The statement is based on informations supplied by Dr. R. Andrzejewski, the Head of the Station of the Department of Ecology of the P.A.S. in Dziekanów. The elaboration of the obtained results is completed and prepared to printing.

Table II

Species of tapeworm	*Rodentia*				*Insectivora*			
	Clethrionomys glareolus		*Apodemus flavicollis*		*Sorex araneus*		*Sorex minutus*	
	extens.	intens.	extens.	intens.	extens.	intens.	extens.	intens.
Catenotaenia pusilla	4	1—2						
Hymenolepis furcata					3	2—10		
Hymenolepis horrida	1	1						
Hymenolepis muris-sylvatici			1	30				
Hymenolepis singularis					6	1—13	2	10 -20
Hymenolepis stefańskii							1	10
Hymenolepis tripartita					4	1—5		
Vigisolepis spinulosa					9	2—10		
Ditestolepis diaphana					18	10—1300		
Pseudodiorchis kampinosi					2	1500—2300		
Choanotaenia crassiscolex					8	1—10		
Dilepididae gen. sp.					3	1		

plants and environment (transition from damp and muddy fields to completely dry and sandy).

The mammals were caught by using cage-traps, what enabled to collect live specimens.

During the mentioned period I carried out also few preliminary investigations in the invasion of possible intermediate hosts with tapeworms. I dissected 40 specimens of *Geotrupes sylvaticus* Panz., 1 *Carabus coriaceus* L., 1 *C. arvensis* Hbst. and 2 *Tenebrio molitor*. In three specimens of *G. sylvaticus* Panz. I found larvae of *Hymenolepis furcata* (Stieda, 1862), the number of the larvae in a host was 1—300.

Table II shows an arrangement of the species of tapeworms found

and the extensity and intensity of invasion of the individual hosts is pointed out.

Besides the adult forms there were found also: in one *Apodemus flavicollis* Melch. in the liver one specimen of *Strobilocercus fasciolaris* (Rud., 1818) and in one *A. flavicollis* a mass invasion of the liver with unknown yet larvae of tapeworm.

Prof. Dr. E. Żarnowski (Agricultural College of Lublin) has offered me much constructive criticism and valuable advice concerning my investigations. Prof. Dr. K. Petrusewicz has provided me with facilities for studying in the Field Station of the Department of Ecology of the Polish Academy of Sciences in Dziekanów Leśny. Dr. R. Andrzejewski has given me much assistance in collecting and identifying the mammals. To all this persons I wish to express my sincere thanks.

Description of species

Tapeworms from *Rodentia*

Family *Catenotaeniidae* Spassky, 1950

Catenotaenia pusilla (Goeze, 1782) Janicki, 1904

Syn.: *Taenia pusilla* Goeze, 1782; *Alyselminthus pusillus* Goeze, 1782) Zeder, 1800; *Halysis pusilla* (Goeze, 1782) Zeder 1803; *Cladotaenia pusilla* (Goeze, 1782) Zeder, 1803.

This species was found by me in four *Clethrionomys glareolus* Schreb. in quantities ranging from 1—2 in one host.

The morphological structure of the specimens found corresponds generally to the detailed description presented by Joyeux et Baer (1945). There is only a difference in the structure of the cirrus. Joyeux et Baer report, that the cirrus in *Catenotaenia pusilla* is unarmed, however, in the specimens examined by me the cirrus (Fig. 1) was covered markedly with spines. Fig. 1 shows the cirrus not wholely everted. In some proglottides I found the cirrus deprived of spines, an indication, that they may easily fall off. In the proglottides, in which the cirrus is drown into the cirrus pouch, the internal surface of the cirrus is wholely covered with spines.

The prevailing majority of the examined material was constituted by species of the family *Hymenolepididae* Fuhrmann, 1907. The systematics of this family is not yet satisfactorily established in spite of repeated attempts of its revision. One of the recent concepts to establish the classification of tapeworms of this family is

expressed in the work of Spassky (1945), which describes the *Hymenolepididae* of mammals, and the work of Spassky and Spasskaja (1954), which describes the *Hymenolepididae* of birds. Spassky's concept rises a number of reservations, described in detail in a separate work (Rybicka, in print), which attest against the acceptance of this classification. In connection with this I am employing in my work principally the old type of classification and I include all the studied species of *Hymenolepididae* provided with three testes to the genus *Hymenolepis* s. l. From this genus I exclude only the species *Hymenolepis spinulosa* Cholodkovsky, 1906, and include it to the genus *Vigisolepis* Mathevossian, 1945. In this species the neck of the rostellum is covered with hooks and by this characteristic it differs from all the remaining species of the family *Hymenolepididae*. Therefore it seem to be appropriate to separate this species into a discrete genus. The species of *Hymenolepididae* provided with two testes and an unarmed scolex I am including to the genus *Ditestolepis* Sołtys, 1952. The species provided with two testes and a rostellum with numerous small hooks are included to the genus *Pseudodiorchis* Skrjabin et Mathevossian, 1948.

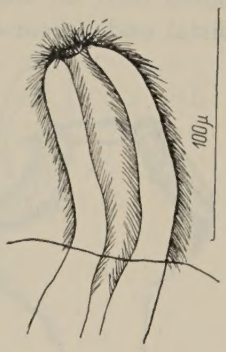

Fig. 1. Cirrus of *Catenotaenia pusillla* (Goeze, 1782) — optical section.

Family *Hymenolepididae* Fuhrmann, 1907

Hymenolepis horrida (Linstow, 1901)

Syn.: *Taenia horrida* Linstow, 1901; *Hymenolepis procera* Janicki, 1904; *H. arvicolina* Cholodkovsky, 1912; *Hymenolepis* sp. Joyeux, 1923; *H. mathevossianae* Achumian, 1946; *Dicranotaenia procera* (Janicki, 1906) Skrjabin et Mathevossian, 1948.

One specimen was found in *Clethrionomys glareolus* Schreb. The length of the tapeworm about 50 mm, maximal breadth 595 μ. The scolex (Fig. 2a) 280 μ in breadth, unarmed, without rostellum, provided with four suckers, 140 μ in diameter.

Mature proglottides short, broad (Fig. 2b). Three testes slightly oval arranged in a triangular, the vasa efferentia unite in the centre of the segment. Bursa cirri reaches or slightly extends

beyond the broad excretory duct. Cirrus covered with spines. Ovary lobate, located in the centre of the segment; behind the ovary the slightly lobated vitellaria. The vagina runs parallelly to bursa cirri on the ventral side of the proglottid and forms at the distal end a pear-shaped dilation.

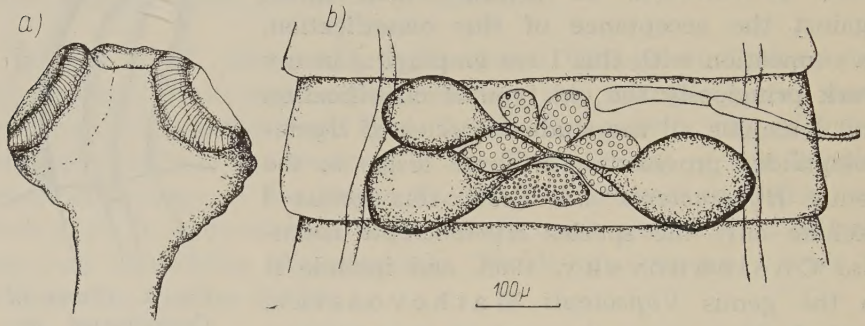

Fig. 2. *Hymenolepis horrida* (Linstow, 1901). a — scolex; b — mature segment.

Achumian (1940) described a new species *Hymenolepis mathevossianae*. The characteristic of this species* does not show differences from that of *Hymenolepis horrida* and from specimen found by me.

Taking into consideration the considerable variability of the form of the scolex and segments and the length of the bursa cirri described accurately by Shiller (1952) the indication is that this species should be classified as synonym of *Hymenolepis horrida* (Linstow, 1901).

Hymenolepis muris-sylvatici (Rudolphi, 1819)

Syn.: *Taenia muris-sylvatici* Rudolphi, 1819.

Thirty tapeworms were found in one *Apodemus flavicollis* Melch.

The immature tapeworms are 25 mm in length, maximal breadth about 600 μ. Breadth of the scolex 175—195 μ, provided with four oval suckers 100—112 μ in length. Rostellum provided with 10 hooks (Fig. 3a) 23—25 μ in length. The handle of the hook

* The original description of Achumian (1946) could not be found by me therefore I am relying on Skrjabin et Mathevossian's (1948) data.

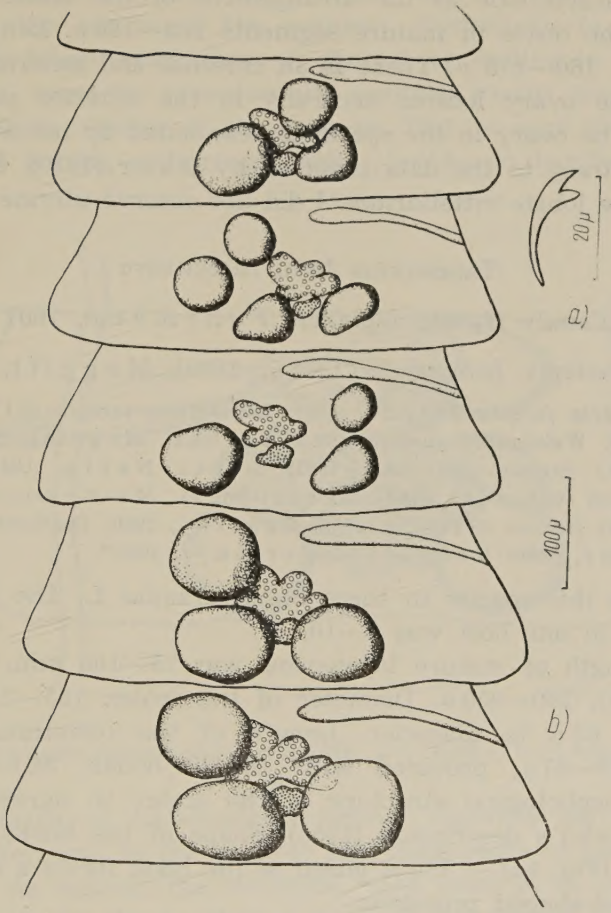

Fig 3. *Hymenolepis muris-sylvatici* (R u d o l p h i, 1819). a — hook; b — mature segments.

somewhat thinner than in the hitherto reported descriptions. The scolex is followed by a long unsegmented neck, 595—700 μ in length, breadth more or less the same as that of the scolex. There are three testes, in the majority of cases 2 of them situated antiporal, and the third one — poral. The variability of the type of the arrangement of the testes in the various segments should be, however, stressed. Particullary marked is the displacement of the anterior testis, which can be in the poral position. I have observed also segments with four testes. The differences are shown on Fig 3b. This is one more example of a lack of stabilization of

such a characteristic as the arrangement of the testes. The diameter of the testes in mature segments 105—126 μ. Length of the bursa cirri 160—175 μ. There is an internal and external seminal vesicle. The ovary located centrally in the anterior part of the segment. The ovary in the specimens examined by me was slightly lobate, contrary to the data reported by Baer (1930). Behind the ovary is the lobate vittellarium. I did not observe uterine segments.

Tapeworms from *Insectivora*

Family *Hymenolepididae* Fuhrmann, 1907

Hymenolepis furcata (Stieda, 1862) Meggitt, 1924

Syn.: *Taenia furcata* Stieda, 1862; *Lepidotrias furcata* (Stieda, 1862) Cohn, 1869; *Weinlandia furcata* (Stieda, 1862) Meggitt, 1927; *Dicranotaenia (D.) furcata* (Stieda, 1862) Lopez-Neyra, 1942; *Dicranotaenia furcata* (Stieda, 1862) Skrjabin et Mathevossian, 1948; *Staphylocystis furcata* (Stieda, 1862) Spassky, 1950; *Dicranotaenia fülleborni* (Milmy, 1936) Kobulej et Versényi, 1953*.

I found this species in three *Sorex araneus* L. The number of specimens in one host was 2—10.

The length of mature tapeworms was 75—100 mm, the maximal breadth 700—950 μ. Diameter of the scolex 165—227 μ, suckers about 65 μ in diameter. Length of the rostellum 61—87 μ, breadth 79—87 μ, provided with 18—20 hooks, 24.5—26.3 μ in length. Morphological structure of the scolex in agreement with Żarnowski's description (1955). Shape of the hooks very charasteristic (Fig. 4a) — blunt guard of the hook forms a broad, concave, shovel-shaped processus.

Structure of the segments (Fig. 4b). Three testes, 45—70 μ in diameter, arranged in a form of a triangle (one in the poral, two in the antiporal position in relation to the vitellarium). Length of bursa cirri 105—150 μ, narrow in the distal part, gradually broadens forming an elongated pear-shaped structure which termina-

* In the presentation of synonyms I am introducing changes in comparison with the data of Skrjabin and Mathevossian (1948), Sołtys (1952), Spassky (1954), Żarnowski (1955), Pojmańska (1957). The named authors cite the synonym *Weinlandia furcata* (Stieda, 1862) Mayhew, 1925. According to the data collected by me Mayhew (1925) introduced into the systematics only the genus *Weinlandia*, but he did not include there the species *Teania furcata*. It was Meggitt (1927) who described this species as *Weinlandia furcata* (Stieda, 1862).

tes in the voluminous external seminal vesicle. Ovary three-lobar, located in the centre of the segment. Posteriorly to the ovary the slightly lobate vitellarium. A short duct leading to the ootype takes origin from the receptaculum seminis. Uterus sac-like, occupies the whole interior of the segment. Mature eggs slightly oval, 27—35 μ in length, embryonal hooks 12—14 μ in length.

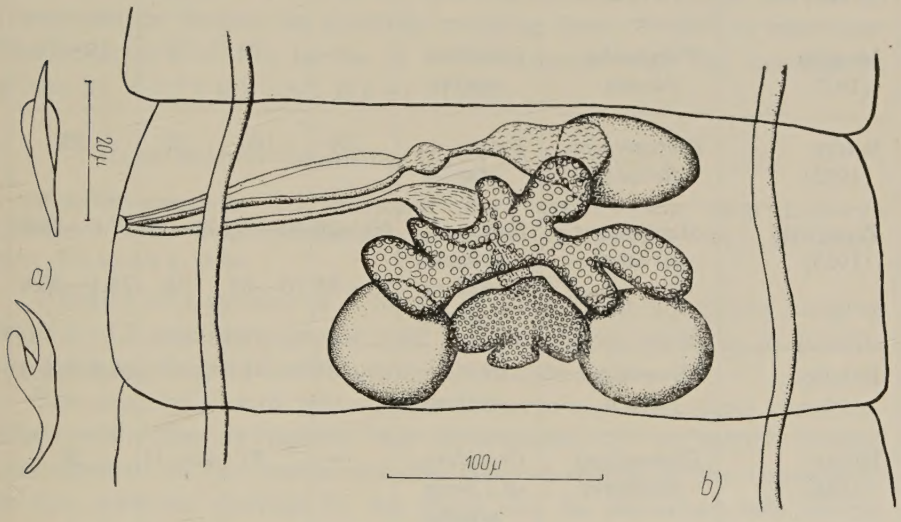

Fig. 4. *Hymenolepis furcata* (S t i e d a, 1862). a — hooks; b — mature segment.

Descriptions of *Hymenolepis furcata* reported till now show certain differences in the number and dimensions of hooks on the rostellum. As regards the structure, very close to *H. furcata* and differing only by the number of hooks is the species *Hymenolepis fülleborni* H i l m y, 1936. Table III includes an arrangement of the reported data referring to the hosts, in which the species were found; dimensions of the rostellum, the number and dimensions of hooks of the two species are also given.

Ż a r n o w s k i (1955) differentiated in the material studied by him two forms of *Hymenolepis furcata*, taking into consideration the difference of the number and dimensions of the hooks. One of the forms occurred in *Sorex araneus* L., and the other — in *Crocidura leucodon* H e r m. In my material, collected from *Sorex araneus* L., I found only the forms, which Ż a r n o w s k i described as typical to *Crocidura leucodon*. In my opinion we are not dealing here with two forms typical to these hosts. However, attention

Table III

Author	Tapeworm species	Host	Rostellum		Hooks	
			length in μ	bre-adth	num-ber	length in μ
Baer (1925)	*Hymenolepis furcata*	*Sorex araneus*	—	130	28	26—28
Meggitt (1927)	*Weinlandia furcata*	*Crocidura murina*	—	70	25	19—24
Sołtys (1952)	*Dicranotaenia furcata*	*Sorex araneus*	100	180	28	25
Żarnowski (1955)	*Staphylocystis furcata*	*Sorex araneus*; *Crocidura leucodon*	60—70 75—85	40—60 70—87	15—20 24	17.6—19.8 23.1—26.4
Rybicka	*Hymenolepis furcata*	*Sorex araneus*	61—87	79—87	18—24	24.5—26.3
Hilmy (1936)	*Hymenolepis fülleborni*	*Crocidura* sp.; *Sorex araneus*	—	51	10—11	29
Kobulej et Versényi (1953)	*Dicranotaenia fülleborni*	*Crocidura leucodon*; *Sorex araneus*; *S. minutus*	—	60—75	15—16	28

should be drawn to the general variability of the number and dimensions of the hooks in *H. furcata*. May be, that this is a characteristic variable within the species in the separate populations.

The material described by Kobulej and Versényi (1953) as *Dicranotaenia fülleborni* (Hilmy, 1936) shows that the number of hooks corresponds to the lower limit found in *H. furcata*. In view of the fact that there is a complete agreement between the description of the structure of the specimens studied by Kobulej and Versényi (1953) and that of *H. furcata*, in my opinion their material should be classified as *H. furcata*, and not as *Dicranotaenia fülleborni*. It is difficult to decide whether *Hyme-*

nolepis fülleborni is in fact a separate species. In *H. furcata* no specimes provided with 10—11 hooks were reported. It should be stressed also that Hübscher (1937) treats *H. fülleborni* as synonym of *H. loossi* Hilmy, 1936 and *Hymenolepis dodecantha* Baer, 1925.

Besides the studied mammals I examined also 40 specimens of *Geotrupes sylvaticus* Panz. In 3 specimens I found larvae of *Hymenolepis furcata* in quantity ranging from 1—300 in one host. The structure of the larvae is in accordance with the description given by Joyeux and Baer (1936).

Hymenolepis singularis Cholodkovsky, 1912

Syn.:*Dicranotaenia (D.) singularis* (Cholodkovsky, 1912) Lopez-Neyra, 1942; *Neoskrjabinolepis schaldybini* Spassky, 1947; *N. singularis* Spassky, 1954.

I found this species in 6 *Sorex araneus* L. in quantities ranging from 1—13 specimens in one host and in 2 *Sorex minutus* in quantities ranging from 10—20 specimens in one host.

The descriptions of this species hitherto reported show considerable variabilities as regards the dimensions of the scolex, hooks, arrangement of the testes and the general length of the tapeworm. In the material studied by me there can be discerned two forms. occurring in two different hosts and which differ above all by the dimensions of the scolex and hooks. The specimens found in *Sorex araneus* L. were provided with scolices 280 μ in diameter and 10 hooks 58—60 μ in length. Breadth of the scolex from specimens collected from *Sorex minutus* L. was 150—190 μ and the hooks (10 in number) were 35—40 μ in length.

The immature tapeworms from *Sorex araneus* L. were 2300—3200 μ in length, from *S. minutus* — 1400—2100 mm in length. In one case I found in *S. araneus* a strobila with an uterus filled with maturing eggs.

The anterior part of the strobilla contains proglottides without reproductive organs. In the subsequent segments are visible three slightly oval testes arranged in a row. I found some cases in which two testes occupied the antiporal, and one the poral position (Fig. 5a); in other ceses all the three testes occupied the antiporal position in relation to the centrally lacated ovary (Fig. 5b). The problem of the arrangement of the testes in *H. singularis* was in the literature many a time discussed. According to Baer (1932) they

form a triangular system, other authors (Cholodkovsky, 1912; Baylis, 1934; Sołtys, 1952; Kobulej, 1953; Żarnowski, 1955; Pojmańska, 1957) found them arranged in a row. In older segments could be observed the ovary and vit-

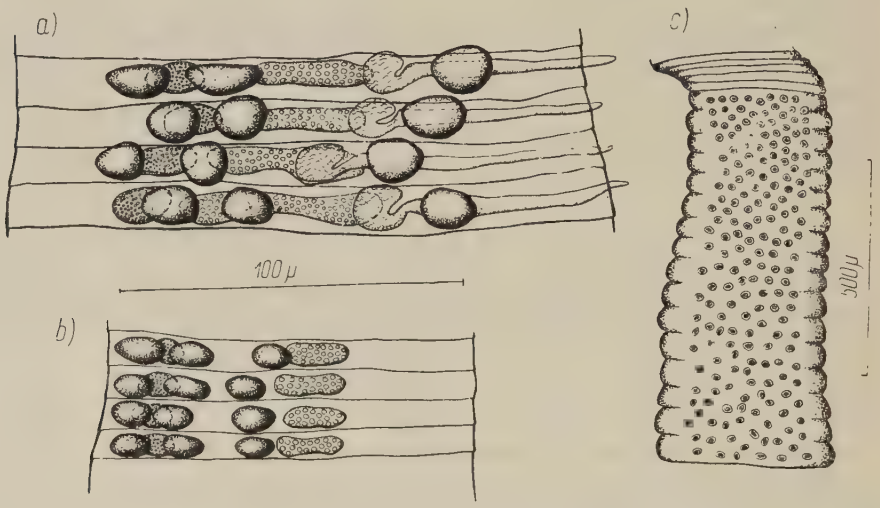

Fig. 5. *Hymenolepis singularis* Cholodkovsky, 1912. a — mature segments; b — mature segments with other arrangement of testes; c — gravid segments.

ellarium located in the antiporal position in relation to the ovary (Fig. 5a). It should be stressed, that in the reported descriptions the vitellarium occupies a central position behind the ovary (Kobulej, 1953; Pojmańska, 1957). In mature proglottides appears relatively early the anlage of the uterus in the from of a transverse band, on the ventral side of the segment. According to Kobulej's (1953) observations, based on examinations of transverse sections, in this species there is an absence of the anlage of the uterus in the form of a transverse band; the fertilized eggs are located in the parenchyma, which forms later a sack enclosing the eggs. My observations are based only on total preparates, but I should like to stress that the band observed by me on the ventral side of the segment in mature segments appears very early, sometimes in segments provided only with testes. In older segments can be observed in this band eggs arranged in a row. Therefore I am describing this band as the anlage of the uterus.

The two forms in my material, found in different hosts and differing by the length of hooks do not offer a basis to

Table IV

Author	Host	Length of hooks in microns
Cholodkovsky (1912)	*Sorex* sp.	55
Baer (1932)	*Sorex araneus*	61 — 62
Baylis (1934)	*Sorex araneus*	34 — 40
Spassky (1947)	*Sorex* sp.	39 — 40
Sołtys (1952)	*Sorex araneus*	60
Kobulej (1953)	*Sorex araneus*	42 — 46
Żarnowski (1955)	*Sorex araneus*	36 — 39
	Sorex minutus	55 — 57
Pojmańska (1957)	*Sorex minutus*	37 — 42
	Crocidura leucodon	
Rybicka	*Sorex araneus*	58 — 60
	Sorex minutus	34 — 40

differentiate here forms typical to those hosts. This is supported by data found in the literature, because different sizes of hooks in this species were found in the same hosts. Baylis (1934) found „small" hooks in specimens collected from *Sorex araneus* L. Other authors (Kobulej, 1953; Pojmańska, 1957) found intermediate forms among the types of hooks differentiated by me. An arrangement of the reported data referring to these characteristics is shown in Table IV.

The data shown in the Table IV indicate that there are considerable differences and there is a variability as regards the size of the hooks in *H. singularis*. The data corroborate also Żarnowski's statement that this characteristic variable within the species may show a certain stability within the separate populations.

Spassky (1947) described a new species *Neoskrjabinolepis schaldybini* found in *Sorex* sp. It differs from *H. singularis* by the formation of a syncapsule in the uterine segments. According to Żarnowski's opinion (1955) this characteristic can appear in *H. singularis*, therefore he regards *Neoskrjabinolepis schaldybini* as synonym of *Hymenolepis singularis*. In the material studied by me I found in *Sorex araneus* one specimen, in which the gravid segments were provided with oncospheres. The borderlines between the segments were marked only on the rims of the proglottides and the uteruses confluenced into one structure (Fig. 5c). Spassky (1947, 1954) does not present any drawing of the syn-

capsule observed by him in *N. schaldybini*, but it should be supposed that its picture was similar to the one observed by me. This observation supports the correctness to regard *Neoskrjabinolepis schaldybini* Spassky, 1947 as synonym of *Hymenolepis singularis* Cholodkovsky, 1912.

Hymenolepis stefańskii Żarnowski, 1954

Syn.: *Vampirolepis stefańskii* (Żarnowski, 1954) Żarnowski, 1955.

Ten specimens were found in one *Sorex araneus* L. This is a new host to this species.

The structure in general accordance with the accurate description given by Żarnowski (1954). The only difference concerns the somewhat smaller size. Table V shows the data collected by Żarnowski (1954) and me.

Table V

Author	Host	length of tapeworm in μ	breadth of scolex in μ	length of hooks in μ	diameter of sucker in μ	Last sexual segment	
						length	breadth
Żarnowski (1954)	*Sorex araneus*	1133	115–182	28–32	70–125	95–160	175–200
Rybicka	*Sorex minutus*	530	105–182	28	65– 70	80– 96	115–158

Attention should be drawn to the considerable likeness of *H. stefańskii* to *H. parvissima* Voge, 1953, found in *Sorex bendirei bendirei* (Merriam). Differences in the shape, size and number of hooks indicate to species separateness of these tapeworms. However, in the course of further revisions of the system the two species should be joined into one genus.

Hymenolepis tripartita (Żarnowski, 1955)

Syn.: *Soricinia tripartita* Żarnowski, 1955.

This species I found in 4 *Sorex araneus* L. One to five specimens were found in a host. Table VI shows an arrangement of dimensions in comparison with Żarnowski's (1955) data.

Fig. 6a represents a total picture of the tapeworm. In the structure of the internal organs (Fig. 6b) the different arrangement of the testes than in Żarnowski's description (1955) should be stressed. In the specimens studied by Żarnowski the testes formed an obtuse-angled triangular. In my material the anterior testis located in the aporal position is nearer the centre of the segment than the posterior testis. The ovary shows a slight outline of a bi-lobate structure.

Attention should be turned to the similarity of this species to *Hymenolepis soricis* Baer, 1928. The difference between the two species concern the different arrangement of the testes (in *H. soricis* the testes are arranged in a row-like way), and different length of the bursa (in *H. soricis* it is considerably shorter than in *H. triparita*).

Genus *Vigisolepis* Mathevossian, 1945

Scolex provided with four suckers and a rostellum with two types of hooks. The apex of the rostellum covered with large hooks, and the neck of the rostellum covered with small hooklets. The genital system odd. Genital pores unilateral. Three testes present.

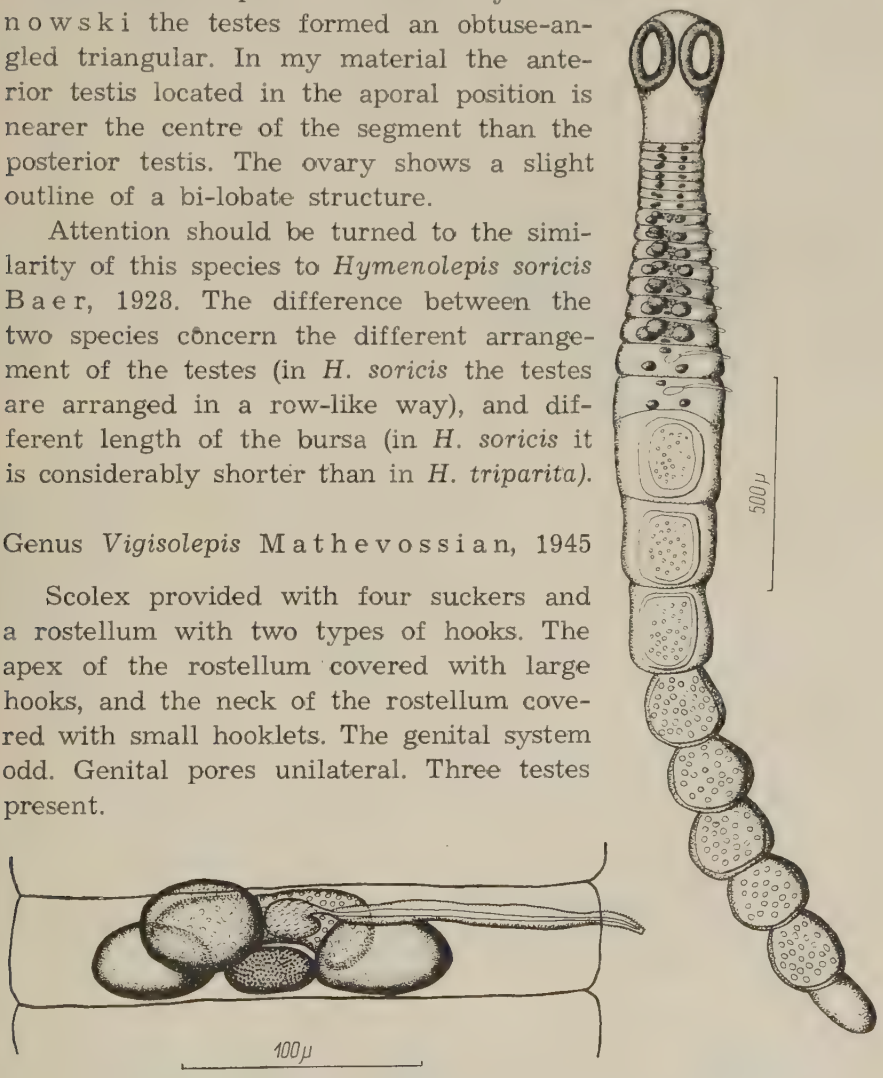

Fig. 6. *Hymenolepis tripartia* (Żarnowski, 1955)
a — entire tapeworm; b — mature segment.

Diagnosis of the genus given by Mathevossian, 1945 and supplemented by Spassky, 1949, still takes into conside-

Table VI

Author	length of the tapeworm in μ	bredth of scolex in μ	diameter of sucker in μ	length of bursa cirri in μ	length of testes in μ
Żarnowski (1955)	0.605–1.782	187–267	170–210	73– 98	36–45
Rybicka	2.632	210	160–210	78–100	53–60

ration the absence of spines on suckers, the arrangement of hooklets on the neck of the rostellum and the type of the arrangement of the testes. The description of such details based on the structure of the hitherto known species seems to me to be an unnecessary narrowing of the diagnosis of a genus, therefore I am not citing these characteristics.

Vigisolepis spinulosa (Cholodkovsky, 1906)

Syn.: *Hymenolepis spinulosa* Cholodkowsky, 1906; *Vigisolepis barboscolex* Spassky, 1949.

This species in quantities ranging from 2—10 specimens I found in 4 *Sorex araneus* L. All the specimens were immature. Maximal length 150 mm, breadth 0.25 mm.

Scolex (Fig. 7a) of dimensions 175—180 μ, provided with four suckers, about 85 μ in diameter. Length of the rostellum 90—110 μ, breadth of the neck of the rostellum 50—63 μ. On the top of the rostellum a characteristic vesicle, 45—63 μ in size. Behind the vesicle appears an irregular ring of hooks, 35—37 μ in length (Fig. 7b). The neck of the rostellum covered with small hooklets. Hooklets which form the ring are somewhat longer — 12,5 μ (Fig. 7c) from the remaining ones, which are 11 μ in length (Fig. 7d), arranged in 6 elongated slightly cone-like bands and have a somewhat different shape.

Young segments (Fig. 7f) are broad, older — are more elongated. Three oval testes, 52—70×26—35 μ in size, two located in the antiporal position, one — in the poral position. Breadth of the cirrus 10 μ, covered with small spines. Bursa cirri 150—230 μ in length, breadth 15—18 μ. External and internal seminal vesicle present. A large, lobate ovary located in the centre of the segment, behind it a compact, spherical vitellarium. The vagina runs ven-

trally to the bursa cirri and has its outlet in the spacious seminal receptacle. The external outlet of the vagina forms a characteristic funnel, described by Sołtys (1952).

Cholodkovsky (1906) reports, that on the rostellum of this species there appear 4 longitudinal bands of small hooks.

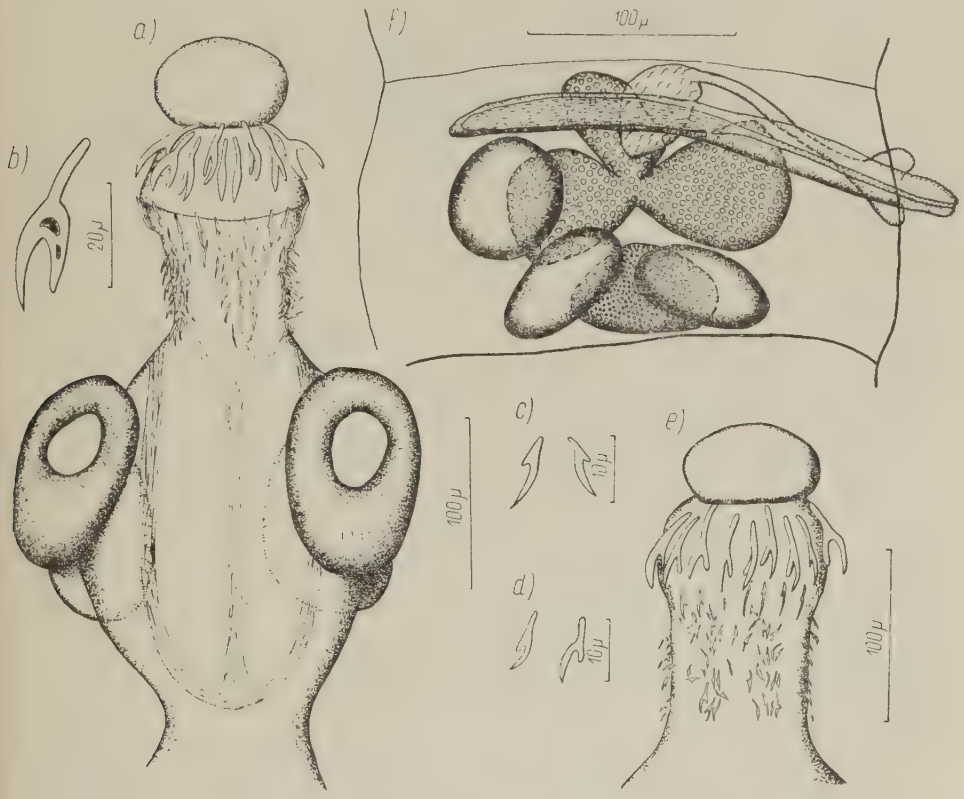

Fig. 7. *Vigisolepis spinulosa* (Cholodkovsky, 1906). a — scolex; b — rostellar hooks; c — hooklets in upper ring of the rostellar neck; d — hooklets in bands on the rostellar neck; e — rostellum; f — mature segment.

Baer (1932) describing this species mentions that the neck of the rostellum is provided with hooklets, but he does not pay attention to the arrangement of the hooks. The drawing presented by Baer (1932) shows that the whole surface of the neck of the rostellum is covered with hooks. Spassky (1949) found specimens with 6 bands of hooks on the rostellum and therefore he described this species as *Vigisolepis barboscolex*. Sołtys (1953) differentiates in

his material *V. spinolosa* and *V. barboscolex*, whereby the diagnosis of the latter species is not in accordance with Spassky's diagnosis (1949), because according to Sołtys there are 4 bands of hooklets. Pojmańska found specimens provided with 6 bands, and describes them as *V. barboscolex*.

In the specimens studied by me there were on the neck of the rostellum 6 bands of hooklets. The accurate determination of the number of bands is very difficult at some positions of the rostellum. Such a position as shown in Fig. 7e shows clearly the presence of 6 bands, but such a position as in the Fig. 7a creates an appearance of the presence of only 4 bands. Only after an exact analysis of the thickness of the lateral layers of the hooklets it can be shown that there are two pairs of two bands mutually covering themselves. I suppose that owing to difficulties in the exact determination of this characteristic the differences appeared in the reported descriptions. At the same time, however, in my opinion even the possibility of the appearance of forms with 4 and 6 bands does not offer a sufficient basis to regard them as separate species. Therefore the material collected by me I am describing as *Vigisolepis spinulosa* (Cholodkovsky, 1906), and I treat *V. barboscolex* Spassky, 1949 as a synonym.

Genus *Ditestolepis* Sołtys, 1952

Tapeworms with an unarmed scolex. In the segments there are two testes. The strobilae divided into metameric segments with proglottides of not uniform degree of development.

Ditestolepis diaphana (Cholodkovsky, 1906) Sołtys 1952

Syn.: *Hymenolepis diaphana* Cholodkovsky, 1906; *Dicranotaenia diaphana* (Cholodkovsky, 1906) Skrjabin et Mathevossian, 1948; *Neoskrjabinolepis diaphana* (Cholodkovsky, 1906) Kobulej, 1953; *Soricinia diaphana* (Cholodkovsky, 1906) Żarnowski, 1955.

I found this species in 18 *Sorex araneus* L. in quantities ranging from 10 to 1300 specimens in one host.

The strobila consists of three distinct series, including segments of not uniform degree of development. The gravid segments (third series) break off from the whole strobila and in such segments the development of the oncospheres takes place. The length of the whole tapeworm jointly with the preserved stil uterine segments reaches 5.7 mm.

Unarmed scolex 70—126 μ in length, breadth 70—160 μ, provided with four suckers. The structure of the scolex in accordance with the accurate drawings given by Sołtys (1952). The struc-

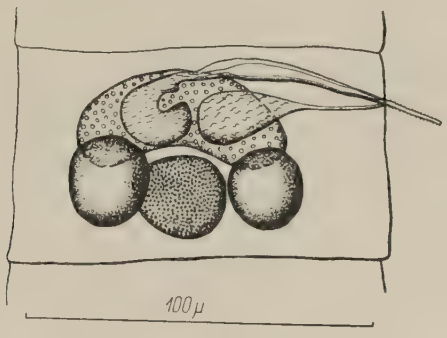

Fig. 8. Mature segment of *Ditestolepis diaphana* (Cholodkovsky, 1906).

ture of the sexual segments is shown in Fig. 8. Two spherical testes are located closer to the posterior rim of the segment. Bursa cirri reaches the centre of the segments or surpasses it. The external and internal seminal vesicle present The cirrus covered with delicate spines. The ovary, slightly horse-shoe like, is located in the anterior part of the segment. The large spherical vitellarium is located behind the ovary. The vagina, very narrow, runs on the ventral side of the segment parallelly to the bursa cirri and has its outlet in the spacious seminal receptacle. The uterus develops in the third series of segments. In the specimes observed by me, similarly to Żarnowski (1955), I did not find the phenomenon of the confluence of uteri and the formation of syncapsules contrary to the data reported by Sołtys (1952).

The problem, how many testes are present in this species was the subject of much discussion. Cholodkovsky (1906) reports that this species is provided with three testes (2 in an antiporal position and 1 located in the centre of the segment) but in the drawing of the strobila only 2 testes are shown. Sołtys (1952) on the basis of his observations of total preparates and microscopic slides describes two testes (1 in the antiporal, the second in the poral position), whereby the author takes into consideration also other morphological and biological characteristics and forms for this species a new genus *Ditestolepis* Sołtys, 1952. Kobulej and Versényi (1953), and Kobulej (1953) on the basis of their observations

confirm the presence of three testes (2 in the antiporal and one in the poral position); their arrangement may be variable according to the III and V types. Finally Kobulej taking into consideration the remaining characteristics of this species places it in the genus *Neoskrjabinolepis* Spassky, 1947.

Żarnowski (1955) reports, that „in the first series of proglottids there appear in the total preparates distinctly only two testicular vesicles. However, in the second series, which includes sexually mature segments, besides the well marked oblong two testes, there appears at the posterior rim of the proglottid a third testicular vesicle, close to, or dorsally to the external seminal vesicle. In the latter case the third testis, on the background of the seminal vesicle which is strongly bent, is berely visible". This is a corroboration of Kobulej's data (1953) an the presence of three testes in this species. As regards the general type of the structure this species was included by the author to the genus *Soricinia* Spassky et Spasskaja, 1954.

In my material I observed constantly two testes. By using borax or alum carmine the testes in young segments are taking an intensively red colour, in older they become transparent, barely stained. By using Blachin's carmine they take a dark-violet colour even in older segments. Simultaneously in the older segments the stain is taken up intensively by the external seminal vesicle, which appears as an oblong folded sac. The folds of this structure take sometimes such a position, that the terminal part becomes curved towards the base, thus creating on the preparates an appearance of two vesicles. One of them was regarded by Żarnowski (1955) as the external seminal vesicle, and the second as the third testis. The author describes, therefore, that the third testis is not visible till in the mature segments, what corresponds exactly to the well developed external seminal vesicle.

In view of the fact that two testes were found in this species I am determining it as *Ditestolepis diaphana* (Cholodkovsky, 1906) Sołtys, 1952.

Genus *Pseudodiorchis* Skrjabin et Mathevossian, 1945

Hymenolepididae of small dimensions. Scolex armed with a ring of very numerous small hooks. Two testes.

Pseudodiorchis kampinosi Rybicka, 1958

Found in the intestine of 2 *Sorex araneus* L. in quantities of about 1550 and 2300 specimens. A detailed description of the morphological structure is given in a separate paper (Rybicka, 1958b).

Family *Dilepididae* Fuhrmann, 1907

Choanotaenia crassiscolex Linstow, 1890

Syn.: *Taenia crassiscolex* Linstow, 1890; *Monopylidium soricium* Cholodkovsky, 1906; *Amoebotaenia subterranea* Cholodkovsky, 1906; *Choanotaenia soricina* (Cholodkovsky, 1906) Fuhrmann, 1908; *Anomotaenia subterranea* (Cholodkovsky, 1906) Fuhrmann, 1908; *Monopylidium scutigerum* Baer, 1928 (nec *Taenia scutigera* Dujardin, 1845)*.

Fig. 9. Mature segment of *Choanotaenia crassiscolex* (Linstow, 1890).

This species was found by me in 8 *Sorex araneus* L. in quantities ranging from 1 to 10 specimens in one host. The length of the tapeworms attains 30 mm, maximal breadth 1.5 mm. Scolex 400—700 μ in length, 450—700 μ in breadth, provided with four suckers 315—490 μ in length. There are on the rostellum about 18 hooks arranged in two rows. Length of the hooks 40—50 μ. In the majority of the specimens the rostellum was hidden in an oblong sheath 455—580 μ in length. The scolex is followed by a long unsegmented neck.

*) The synonyms presented by me show a difference as compared with data of Baer (1928), Zarnowski (1955), Pojmańska (1957). According to the data collected by me the name *Choanotaenia soricina* (Cholodkovsky, 1906) was for the first time introduced by Fuhrmann (1908) and not by Meggitt (1924).

The segments (Fig. 9) short, broad, the genital pores lying irregularly alternately. The structure of the reproductive organs in accordance with the reported descriptions. The only difference observed by me is the armed cirrus. Kobulej and Wierszenyj (1953) describing this species as *Anomotaenia subterranea* (Cholodkovsky, 1906) report that the cirrus is unarmed. Other authors do not deal with the structure of the cirrus.

In the material studied by me, almost all segments were in the course of copulation, whereby the copulation takes place in the same segment (Fig. 9).

Dilepididae gen. sp.

In three *Sorex araneus* L. I found in the intestine one immature tapeworm, which in the absence of mature segments I could not diagnose accurately. The length of the examined species was 1.45—2.31 mm, breadth of the scolex 455—555 μ. The scolex provided with four suckers 135—170 μ in diameter and a short restellum 175—280 μ in breadth with a double ring of hooks about 50—60 μ in number. Length of the larger hooks (Fig. 10a) 98 μ, of the smaller ones (Fig. 10b) 82—89 μ. Behind the scolex are visible outlines of the segments, but they do not contain yet any organs.

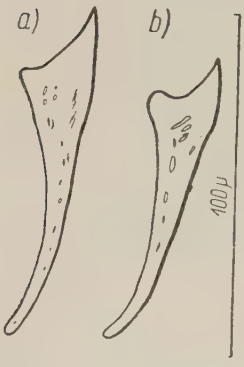

Fig. 10. Young form of *Dilepididae* gen. sp. a — large hook; b — small hook.

A similar specimen was found by Sołtys (1954) in the intestine of *Sorex minutus* L. and he diagnosed it as a closer not differentiated larval form. The specimen found by Sołtys was characterized by somewhat shorter hooks.

Larval forms

Family *Taeniidae* Ludwig, 1886

Strobilocercus fasciolaris (Rudolphi, 1808)

Syn.: *Cysticercus fasciolaris* Rudolphi, 1806.

One specimen was found by me in the liver of *Apodemus flavicollis* Melch.

The larval form not classified

In one *Apodemus flavicollis* M e l c h. I found in the liver a mass occurrence of small larvae in spherical white cysts, 1—1.5 mm in diameter. The structure of the larva removed from the cyst is

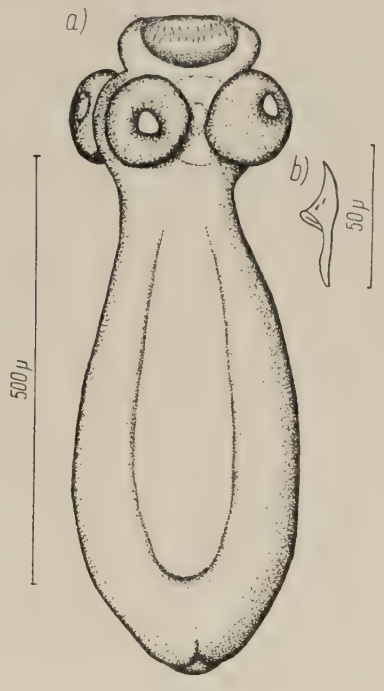

Fig. 11. Undetermined larval form. a — entire larva; b — hook.

shown in Fig. 11a. The length of the body 690—770 μ, scolex 210 μ in length, 245 μ in breadth. On the scolex four suckers 106 μ in diameter. The rostellum is in its appearance similar to the top sucker and is provided with a ring of about 30 hooks (Fig. 11b), 30—33 μ in length.

Talbe VII and VIII show a tabular arrangement of the results of studies of the tapeworms from *Rodentia* and *Insectivora* conducted till now in Poland. The Tables show the terrains on which these studies were conducted, the number of the examined individuals of every host species and the species of tapeworms found in hosts.

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Table

Rodentia	*Clethrionomys glareolus*			*Microtus agrestis*		*Microtus ratticeps*			*Microtus arvalis*			
Territory:	B	P	K	P	L	P	L	T	B	P	L	T
No. of examined hosts:	820	80	7	1	3	3	4	10	73	77	286	649
Catenotaenia lobata Baer, 1925	+								+			
Catenotaenia pusilla (Goeze, 1782)	+	+	+						+			
Paranoplocephala brevis Kinschenblatt, 1938		+								+	+	
Paranoplocephala omphalodes (Hermann, 1783)									+			+
Aprostatandrya macrocephala (Douthitt, 1915)	+	+						+	+	+	+	+
Hymenolepis asymmetrica Janicki, 1904									+	+		+
Hymenolepis diminuta (Rudolphi, 1819)	+											
Hymenolepis fraterna Stiles, 1906	+								+			
Hymenolepis horrida (Linstow, 1901)			+									
Hymenolepis muris-sylvatici (Rudolphi, 1819)												
Hymenolepis myoxi (Rudolphi, 1819)		+										
Hymenolepis straminea (Goeze, 1782)										+		
Sparganum (mansoni?) — larva	+											
Cysticercus Taeniae polyacanthae (Leuckart, 1856)	+											
Strobilocercus fasciolaris (Rudolphi, 1818)	+									+		+
Cysticercus longicollis Rudolphi, 1819												
undetermined larval forms												

Explanations: B — Białowieża Wilderness (Sołtys, 1949); P — environment of Puławy
vironment of Turew near Poznań (Pojmańska, 1957); K — Kampinos Wild-

VII

Microtus subterraneus			*Micromys minutus*		*Apodemus agrarius*			*Apodemus flavicollis*				*Apodemus sylvaticus*			*Mus musculus*				*Muscardynus avellanarius*	*Ondatra zibethica*
B	P	L	P	T	P	L	T	K	B	P	L	K	P	L	T	P	L	T	K	K	Bd
16	18	1	8	15	18	191	16	5	28	1	20	8	24	70	18	2	112	4	1	5	100
									+					+			+				
+						+							+	+							
+								+								+					
	+											+									+
																					+

(Żarnowski 1955); L — environment of Lublin (Furmaga, 1957); T — enerness (present paper); Bd — Bydgoszcz (Grabda, 1954).

Table VIII

Insectivora	*Sorex araneus*				*Sorex minutus*				*Sorex macropygmaeus karpinskii*	*Neomys fodiens*			*Neomys anomalus milleri*	*Crocidura leucodon*	*Crocidura mimula*	*Talpa europaea*	
Territory:	B	P	T	K	B	P	T	K	B	B	P	T	B	P	T	P	T
No. of examined hosts:	2439	134	45	28	749	41	16	2	50	288	11	5	71	25	6	9	2
Hymenolepis anacetabula Sołtys, 1954													+				
Hymenolepis bacillaris (Goeze, 1782)																+	
Hymenolepis furcata (Stieda, 1862)	+	+	+	+						+				+			
Hymenolepis globosoides (Sołtys, 1954)					+					+			+				
Hymenolepis infirma (Żarnowski, 1955)		+				+											
Hymenolepis scalaris (Dujardin, 1845)			+												+		
Hymenolepis scutigera (Dujardin, 1845)		+	+			+											
Hymenolepis singularis Cholodkovsky, 1912	+	+	+	+	+	+	+	+	+								

Hymenolepis soricis Baer, 1928									+									
Hymenolepis stefańskii Żarnowski, 1954		+						+										
Hymenolepis tiara (Dujardin, 1845)												+						
Hymenolepis tridontophora (Soltys, 1954)					+					+								
Hymenolepis tripartita (Żarnowski, 1955)		+		+														
Vigisolepis spinulosa (Cholodkovsky, 1906)	+			+	+		+		+									
Ditestolepis diaphana Cholodkovsky, 1906	+	+		+	+	+			+									
Pseudodiorchis kampinosi Rybicka, 1958				+														
Pseudodiorchis multispinosa Żarnowski, 1955		+																
Choanotaenia crassiscolex (Linstow, 1890)	+	+	+	+	+				+	+								
Choanotaenia hepatica (Baer, 1932)	+	+																
Dilepididae gen. sp.				+	+													
Sparganum sp.? — larva	+									+								
Cysticercus sp.?	+																	

Explanations as in Table IX

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STRESZCZENIE

Autorka omawia w pracy tasiemce drobnych ssaków leśnych (*Rodentia* i *Insectivora*), znalezione na terenie Puszczy Kampinoskiej k/Warszawy. Stan zarażenia pasożytami poszczególnych gatunków badanych ssaków ilustruje tab. I. W tab. II podane jest zestawienie znalezionych gatunków tasiemców, oraz ekstensywność i intensywność zarażenia nimi poszczególnych żywicieli.

Autorka zalicza wszystkie badane gatunki *Hymenolepididae* o trzech jądrach do rodzaju *Hymenolepis* s. l. Wyłącza jedynie rodzaj *Hymenolepis spinulosa* Cholodkovsky, 1906, zaliczając go do rodzaju *Vigisolepis* Mathevossian, 1948, ze względu na bardzo specyficzne uzbrojenie szyjki rostellum u tego gatunku. Gatunki *Hymenolepididae* o dwóch jądrach i nie uzbrojonym skoleksie zalicza do rodzaju *Ditestolepis* Sołtys, 1952, gatunki o dwóch jądrach i skoleksie opatrzonym licznymi hakami do rodzaju *Pseudodiorchis* Skrjabin et Mathevossian, 1948.

Następnie autorka daje przegląd znalezionych przez siebie gatunków, zwracając uwagę na cechy dotychczas nie zauważone lub interpretowane odmiennie przez różnych autorów.